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Scientific Opportunities for High Resolution Inelastic X-ray Scattering with an XFELO Source

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Inelastic X-ray scattering with meV energy resolution has become a valuable technique for studying the vibrational excitations in a wide variety of systems. It has similar count rates to the more commonly used technique of neutron scattering, but can be used on much smaller samples, including those under high pressure. The main limitation with the current generation of sources is the number of photons which can be delivered in the proper energy bandwidth. An XFELO source offers the possibility of increasing the number of photons by up to six orders of magnitude, which will enable a vast number of new and improved experiments. In addition, the XFELO offers the opportunity to tune the photon energy, which may allow for resonant studies.